ADAPTIVE AUDIBLE ALERT VOLUME CONTROL

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates generally to volume control in an electronic device. Particularly, the present invention relates to automatic volume control of an audible alert tone in an electronic device.

Description of the Related Art

[0002] The popularity of the cellular telephone and other mobile communication devices has created both a favorable and an unpleasant effect for the average consumer. On the one hand, the convenience of being able to call anywhere in the world while driving down the interstate highway can greatly increase the efficiency and productivity of most people. On the other hand, the ubiquitous nature of the cellular telephone and their alert tones can be annoying and disruptive.

[0003] For example, a loud telephone alert tone going off in a library would tend to bother anyone within a hundred feet of the telephone. Courtrooms and most meetings ban the use of the cellular telephone due to the disruptive nature of their alert tones.

[0004] Typically, a cellular telephone has a control function to reduce or mute the alert tone. In fact, a number of modern cellular telephones have a vibration mode that alerts the user to a call while not bothering others around the user. However, if the user has come from a noisy environment, such as the car, to a quiet environment, such as a meeting, the user must remember to either turn down the alert tone volume or turn off the telephone completely. There is a resulting need for an automatic alert tone volume adjustment process in a communication device.

SUMMARY OF THE INVENTION

[0005] The present invention encompasses a process for automatically modifying an alert tone volume of a mobile communications device. In the preferred embodiment, the mobile communications device is a cellular telephone that has a microphone, an alert tone generator, and a vibrating alert generator.

[0006] The process of the present invention is initiated when an incoming call indication is received. The communications device's controller samples the ambient sound level. This sampled signal is then compared to a threshold to determine whether to activate the vibrator alert generator or to activate the alert tone generator and adjust its output level.

[0007] In one embodiment, the ambient sound level is compared to a plurality of sound level thresholds. If the ambient sound level is less than a predetermined minimum level (i.e., the surrounding area is quiet), the vibrator alert generator is activated in order to alert the user to an incoming call without disturbing others in the quiet surroundings.

[0008] If the ambient sound level is greater than the minimum threshold but less than a mid-level threshold, the alert tone generator is activated and set at a low volume. If the ambient sound level is between the mid-level threshold and a high threshold, the alert tone generator is set to a mid-level volume. Finally, if the ambient sound level is greater than the high threshold, the alert tone generator is set to a high volume.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. 1 shows block diagram of a communication device in accordance with the present invention.

[0010] FIG. 2 shows a flowchart of the adaptive audible alert tone volume adjust process of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0011] The adaptive audible alert volume control process of the present invention provides a user of a cellular telephone with the ability to use the telephone in various areas without worrying about manually changing the alert volume or turning the telephone off. This is accomplished by adjusting the alert tone's volume in response to the ambient noise levels.

[0012] The subsequent discussion of the present invention refers to a cellular telephone. It is understood, however, that the adaptive process works with any form of communication device that has an alert tone generator and a microphone to sample the ambient noise levels. These communication devices include radios such as MOTOROLA'S TALKABOUT radios and cordless telephones for home use.

[0013] FIG. 1 illustrates a block diagram of a cellular telephone that incorporates the adaptive audible alert volume control process. The telephone is comprised of an antenna (115) that transmits signals to and receives signals from a base station. A transmitter (105) is responsible for transmitting any telephone signals from the telephone. For example, if the telephone user were to talk into the telephone's microphone (120), the speech signal would be processed by the controller (101) and transmitter (105) to be compliant with the appropriate air interface technology (e.g., code division multiple access) before being transmitted by the transmitter (105).

[0014] A receiver (110) is coupled to the antenna (115) to process any received telephone signals. For example, an incoming call indication signal might be received to indicate that another party is trying to reach the telephone's user.

[0015] The controller (101) is a processor or a microcontroller that controls the operation of the telephone. The controller (101) is responsible for performing the processes of the present invention.

[0016] The microphone (120) receives the speech signal and converts it into an electrical representation for processing by the controller (101) and transmitter (105). The adaptive audible alert volume control process uses the microphone (120) to sample the ambient sound levels of the telephone's environment.

[0017] In an alternate embodiment, the telephone is comprised of a second microphone that is separate from the normal telephone microphone (120). This second microphone is dedicated to the sampling of the ambient noise levels.

[0018] A speaker (125) radiates any voice signals received by the telephone and processed by the receiver (110) and controller (101). For example, the speech signal of the calling party is received and processed by the receiver (110) and controller (101) before being sent to the speaker (125) for conversion into an aural signal.

[0019] A display and keypad (135) are used to input and display data. The telephone user can determine the operating status of the telephone by display (135) indications. The user can also enter telephone numbers and other data with the keypad in conjunction with the display (135).

[0020] An alert transducer (130) generates the tones required to alert the telephone user to an incoming call. The alert transducer (130) receives signals of different frequencies and power levels from the controller (101). The transducer (130) then vibrates at those frequencies and levels under control of the process of the present invention.

[0021] A vibrating alert generator (140) is another means by which the telephone's controller (101) can alert the user to an incoming telephone call. The vibrating alert generator (140) is coupled to the telephone's housing and causes it to vibrate when so instructed by the controller (101) under command of the process of the present invention.

[0022] FIG. 2 illustrates a flowchart of the adaptive alert volume control process of the present invention. The process is initiated when an incoming call indication signal is received. The telephone's controller samples the ambient noise levels through the telephone's microphone (step 201).

[0023] The sampling process, in the preferred embodiment, is accomplished by the controller monitoring and digitizing the incoming ambient noise from the microphone. This digitizing process is well know in the art and is not discussed further. In an alternate embodiment, the sampling of the ambient noise through the

microphone is accomplished in an analog fashion whereby the ambient signal strength is determined without digitizing the ambient noise signal.

[0024] The sampled ambient noise level is then compared to at least one threshold (step 205). In the preferred embodiment, the sampled ambient noise level is compared to multiple thresholds in order to determine at what volume level to set the audible alert. This permits the process of the present invention to take advantage of the multiple alert volume levels available on a cellular telephone.

[0025] The process first compares the sampled ambient noise level to the lowest threshold (step 210). If the noise level is less than this level, the telephone is in very quiet surroundings and any audible alert tone would be too much. Therefore, the telephone's vibrating alert generator is activated to indicate the incoming call.

[0026] If the noise level is greater than the lowest noise threshold but less than a predetermined mid-range threshold (step 220), the audible alert transducer is activated at its lowest volume setting (step 225). If the noise level is greater than the mid-range threshold but less than a maximum noise level threshold (step 230), the alert transducer is activated at a mid-level volume (step 235) to indicate the incoming call.

[0027] If the noise level is greater than the maximum noise level threshold (step 230), the alert transducer is activated at it highest volume setting (step 240) to indicate the incoming call. In one embodiment, the audible alert transducer as well as the vibrating alert generator are activated at this level since the user may not hear the audible alert transducer in such a noisy environment. In this case, the vibrating telephone may catch the user's attention before the audible alert transducer.

[0028] In one embodiment, the different thresholds of the present invention are determined by experimentation and then programmed into the telephone's firmware. For example, experimentation may show that 20 dB should be the lowest threshold, 60 dB should be the mid-range threshold, and 80 dB should be the high range threshold. These values would then be programmed into the telephone such that the process of the present invention automatically checks against these levels. These thresholds are for illustration purposes only. The present invention encompasses an unlimited range of threshold quantities as well as various threshold levels.

[0029] In an alternate embodiment, the user is able to program their own thresholds into the telephone. The user may call up a menu item that instructs the controller to sample the ambient noise levels at the time that the user pushes a button or switch. This sampled level is then programmed into the telephone as the level that is chosen by the user. This process is then continued until all of the available thresholds are chosen.

[0030] In summary, the adaptive audible alert volume control process of the present invention provides a cellular telephone user with the convenience of using the telephone without worrying that the alert tone will bother others at an inappropriate time. By comparing a sampled ambient noise level to a threshold or multiple thresholds, the volume of the alert tone can be adjusted in a dynamic manner.